What is claimed is:

CLAIMS

1. A controller for controlling at least one piezo actuator coupled frictionally with at least one positioning member to move the at least one positioning member in either of two directions as determined by relative absolute rates of expansion and contraction of the at least one piezo actuator; and the controller comprising:

a logic for generating digitized pulses each with a rising edge and a falling edge and with relative absolute values of corresponding average slopes of the rising edge and the falling edge of each of the digitized pulses corresponding with a selected direction of movement of the at least one positioning member;

a digital-to-analog (A/D) converter with an input coupled to said logic and an output coupled to said at least one piezo actuator, and the A/D converter converting said digitized pulses at said input to an analog waveform at said output to move said at least one positioning member in the selected direction.

2. The controller of Claim 1, further comprising:

an amplifier coupled between said A/D converter and said at least one piezo actuator for amplifying said analog waveform to a level sufficient to move said at least one positioning member in the selected direction.

3. The controller of Claim 1, wherein said logic further comprises:

a memory for storing data corresponding to the digitized pulses; and

a processor with an input coupled to said memory and an output coupled to said A/D converter, and said processor responsive to instructions to move said at least one positioning member in a selected one of the two directions to read said data and to iteratively write digitized pulses at the output with relative absolute values of the corresponding average slopes of the rising and falling edges of each pulse corresponding with the selected one of the two directions of movement.

4. The controller of Claim 3, wherein the data stored in said memory includes at least one of an ordered sequence of numbers and a function for generating the ordered

sequence of numbers and with the ordered sequence of numbers corresponding with at least one of the digitized pulses.

5. The controller of Claim 3, wherein the data stored in said memory includes an ordered sequence of numbers which when read by said processor and written to said A/D converter in a selected one of either of two opposing directions results in movement of the at least one positioning member in a corresponding one of either of the two directions.

6. The controller of Claim 3, wherein the data stored in said memory includes a first ordered sequence of numbers for moving said at least one positioning member in a first of the two directions and a second ordered sequence for moving said at least one positioning member in a second of the two directions.

7. The controller of Claim 3, with said processor responsive to instructions to increase a speed of movement of said at least one positioning member to decrease an interval between the iterative writing of each of the digitized pulses to said A/D converter while substantially maintaining the duration of each of the digitized pulses.

8. The controller of Claim 1, wherein said at least one piezo actuator includes a first piezo actuator and a second piezo actuator and said controller further comprising:

a multiplexer with a control input, a signal input, and a pair of outputs, and the signal input coupled to the output of said A/D converter and a pair of outputs each coupled to a corresponding one of the first piezo actuator and a second piezo actuator, and the multiplexer responsive to a control signal at the control input to couple a selected one of the first piezo actuator and the second piezo actuator to the A/D converter.

9. The controller of Claim 1, further comprising:

an electrical sink switchably coupled to the output of said A/D converter to remove charge from said at least one piezo actuator after movement of said at least positioning member in the selected direction.

10. The controller of Claim 1, further comprising:

a position detector with an input coupled with said at least positioning member and an output coupled to said logic and said position detector generating at the output a position feedback signal corresponding with the position of said at least one positioning member; and

said logic responsive to a said position feedback signal to move said at least one positioning member to a desired position.

11. A method for controlling at least one piezo actuator coupled frictionally with at least one positioning member to move the at least one positioning member in either of two directions as determined by relative absolute rates of expansion and contraction of the at least one piezo actuator, and the method for controlling comprising the acts of:

generating digitized pulses each with a rising edge and a falling edge and with relative absolute values of corresponding average slopes of the rising edge and the falling edge of each of the digitized pulses corresponding with a selected direction of movement of the at least one positioning member;

converting said digitized pulses to an analog waveform; and

driving said at least one positioning member with said analog waveform to move said at least one positioning member in the selected direction.

12. The method for controlling of Claim 11, wherein said driving act further comprises the act of:

amplifying said analog waveform to a level sufficient to move said at least one positioning member in the selected direction.

13. The method for controlling of Claim 11, wherein said at least one piezo actuator includes a first piezo actuator and a second piezo actuator and wherein said driving act further comprises the act of:

selectively driving a selected one of the first piezo actuator and a second piezo actuator.

14. The method for controlling of Claim 11 wherein said driving act further comprises the act of:

switchably coupling an electrical sink to remove charge from said at least one piezo actuator after movement of said at least positioning member in the selected direction.

15. The method for controlling of Claim 11, further comprises the act of:

generating a position feedback signal corresponding with the position of said at least one positioning member; and

moving said at least one positioning member to a desired position responsive to a the position feedback signal generated in said act of generating.

16. The method for controlling of Claim 11, wherein said generating act further comprises the acts of:

storing data corresponding to the digitized pulses; and

moving said at least one positioning member in a selected one of the two directions by;

a) reading said data; and

b) iteratively writing digitized pulses with relative absolute values of the corresponding average slopes of the rising and falling edges of each pulse corresponding with the selected one of the two directions of movement.

17. The method for controlling of Claim 16, wherein said storing act further comprises the acts of:

writing at least one of an ordered sequence of numbers and a function for generating the ordered sequence of numbers into said memory with the ordered sequence of numbers corresponding with at least one of the digitized pulses.

18. The method for controlling of Claim 16, wherein the data corresponds with an ordered sequence of numbers and wherein further said act of iteratively writing further comprises the acts of:

reading the ordered sequence of numbers in a selected one of either of two opposing directions to move the at least one positioning member in a corresponding one of either of the two directions.

19. The method for controlling of Claim 16, wherein the data includes a first ordered sequence of numbers for moving said at least one positioning member in a first of the two directions and a second ordered sequence for moving said at least one positioning member in a second of the two directions.

20. The method for controlling of Claim 16, wherein said act of iteratively writing further comprises the acts to increase a speed of movement of said at least one positioning member of:

decreasing an interval between the iterative writing of each of the digitized pulses to said A/D converter; and

substantially maintaining the duration of each of the digitized pulses.

21. The method for controlling of Claim 16, wherein said storing act further comprises the act of:

updating the data stored in said storing act with updated digitized pulses.